A Commercial Story:
Midaz Lasers Ltd – *from Research to Product to Exit*

Michael Damzen
Founder
Director & CTO

Presentation to “Siegman International School of Lasers”
10th August 2017
Mike Damzen – “the academic”

- Professor of Experimental Laser Physics @ Imperial College London
- Academic researcher for 30 years
  - Fellow of the Institute of Physics (IoP)
  - Fellow of the Optical Society of America (OSA)
  - 150 peer-reviewed journal papers
  - ~250 conference presentations
  - 2 books & 6 book chapters
  - 6 patents
  - ~ 40 successfully completed PhD students
Lasers = exciting science + enabling technology
Lasers – Enable Our Modern World

Communication

Manufacture

Medical
Limitless potential of Light!

- **Sensing**
- **Projection**
- **Metrology**

- **Energy**
- **Fundamental science**
- **Defence**
The Road to Spin-Out (1/2)

**Technology**

- Ultra-high efficiency, high power lasers built since 2001

**IP**

- Key Patent Filed (2002)
- Further Filings prior to company formation (2006)

**Drive for Spin-Out**

- Strong Interest from multi-billion $ US company (2005)
The Road to Spin-Out (2/2)

**Formation of Team:**
- Founder (CTO)
- Co-founder (CSO)
- Chairman (Business Angel)
- Business Development Manager
- Imperial Innovations (Director)
- Finance Officer / Secretary

**Formation of a Business Plan**

**Freedom to operate secured**

**Pitch to Investors**

**Investment & Company Operation Started**
- June 2006
Performance breakthrough

World’s highest gain solid-state laser amplifier

- Ultra-high Amplifier gains
  - \( \sim 100,000 \)

- Shortest DPSS Q-switched pulses
  - \(< 10\text{ns}\)

- Ultra-high Q-switched rep rates
  - \( \sim \text{MHz} \)

- High peak power capability
  - \( > 10 \text{ MW} \)
Key market: laser industrial manufacturing (~$2.5B)

“where our superior laser peak power (MW) & performance leads to faster (x5), smaller (x5) & significantly lower cost (x5) manufacturing of high-tech products.”
Operating in Imperial Incubator
First Packaged Laser – Aug 2006
First Installation – August 2006

Driven in departmental transit van – to North Wales!

First Revenue – after 2 months operation!!
Product Evolution
Challenge 1: Know customer needs (1/2)

Engage with end-user (customer) as soon as possible!

In our case end-user was an industrial customer or Systems Integrator
Challenge 1: Know customer needs (2/2)

Midaz engaged with customers in several HIGH VALUE market sectors:

- Silicon cutting and scribing (defect inspection)
- Diamond processing (industrial & gemstones)
- Automotive/Aerospace (e.g. turbine blades)
- Laser ID Marking of high tech products
- Solar cells
- Touch panel displays
- Medical micromachining (e.g. stents)
Challenge 2: Packaging Technology (1/3)

We built many laser prototypes to engage with early customers

but....

a challenging step to engineer production units
Challenge 2: Packaging Technology (2/3)

Early Prototypes – to engage with customers

• Early prototypes helped us engage early with customers

• Customer engagement enabled us to try to develop technology along market-driven route

High energy laser for general processing applications

Our smallest - 25W “matchbox” laser

Our first air-cooled laser for laser marking market

UV laser for processing silicon & touch-screens
Challenge 2: Packaging Technology (3/3)

Engineered “production” unit

- Packaging complex technology is hard
- Don’t forget: Safety / CE marking / regulations
- Reduce Build Cost!!
Product Family - Modular Design

Core Technology

Midaz Amplifier

Engineered Designs

Amplifier Design

Laser Design(s)

Product

Water cooled (A70-W)

Air Cooled (A50-A)

Flair-20 Marking Laser

Mega-Pulse Micromachining Laser (Prototype)

Product: A70-W

Product: A50-A

Product: Flair-20

Prototype: MP-15-355
Midaz Achievements

• **Designed & engineered cutting-edge laser technologies**
  – Ultra-high gain bulk amplifier ($\approx 10^6$)
  – Ultra-high (MHz) rep rate Q-switch pulsed lasers

• **Products sold world-wide**

• **Responsive innovations to meet customer needs**

• **New Technologies trialled & other Contracted work**
  – Adaptive coherent beam combining
  – Diode-pumped Alexandrite lasers
How to do the next step?

How to scale up production to meet volume orders?

1. Invest in manufacturing facility ourselves
2. Strategic partnership for manufacturing
3. (Trade) Sale to company valuing our technology/IP
Successful Trade Sale in 2012!

Midaz Lasers Ltd

- Technology proven to work
- Good IP
- "No Skeletons in the closet"

- Good return on investment
  - low personnel & expenditure ("slow-burn")
  - revenue generation + grant/contract work

Trade Sale to Coherent Lasers

2006

2012
Difficulty for Academic to Spin-Out

- Lack of Business (Market) Knowledge

- Shift from *Curiosity-driven Science* to need to generate *Product* and *Revenue*

- Giving away ‘control’ & stepping back as technology matures

- Not being able to publish your (best) work
Lessons I learnt!

• Technology business is really hard work
  - Small team managing all the company’s needs
  - Packaging complex technology
  - Engaging with customers
  - Cash-flow = deadlines…!!!

• Time always too short – investment always too small

• Preferably have a platform technology
  - “first product is unlikely to be the right one”
What about you?

- Know-how
- Patent
- Licence
- Start-Up Company
- Consultancy
- Or Not